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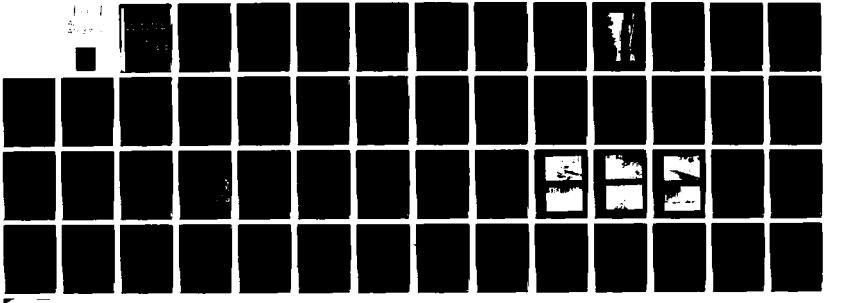

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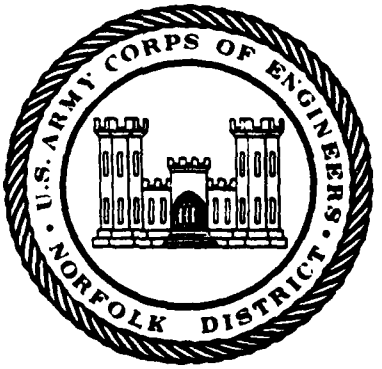
Name of Dam: Thelma Pitts Dam
Location: Caroline County, State of Virginia
Inventory Number: VA 03343

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM



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April 1981

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER: VA 03343
2. GOVT ACCESSION NO.: AD-A103718
3. RECIPIENT'S CATALOG NUMBER: (9)

4. TITLE (and Subtitle): ~~Phase I Inspection Report~~ National Dam Safety Program. Thelma Pitts Dam (Inventory Number VA 03343) York River Basin, Caroline County, ~~Virginia~~: Phase I Inspection Report.
5. TYPE OF REPORT & PERIOD COVERED: Final rept.
6. PERFORMING ORG. REPORT NUMBER: (15)

7. AUTHOR(s): Michael Baker
8. CONTRACT OR GRANT NUMBER(s): DACW 65-80-D-0032

9. PERFORMING ORGANIZATION NAME AND ADDRESS:
U. S. Army Engineer District, Norfolk
803 Front Street
Norfolk, Virginia 23510

10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS

11. CONTROLLING OFFICE NAME AND ADDRESS: (12) 54

12. REPORT DATE: (11) Apr[illegible]81
13. NUMBER OF PAGES

14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office): (10) James A. Walsh

15. SECURITY CLASS. (of this report): Unclassified
15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

Copies are obtainable from National Technical Information Service, Springfield, Virginia 22151

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Dams - VA
National Dam Safety Program Phase I
Dam Safety
Dam Inspection

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

(See reverse side)

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

20. Abstract

Pursuant to Public Law 92-367, Phase I Inspection Reports are prepared under guidance contained in the recommended guidelines for safety inspection of dams, published by the Office of Chief of Engineers, Washington, D. C. 20314. The purpose of a Phase I Inspection is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the gereral conditions of the dam is based upon available data and visual inspection. Detailed investigation and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to idenify any need for such studies.

Based upon the field conditions at the time of the field inspection and all available engineering data, the Phase I report addresses the hydraulic, hydrologic, geologic, geotechnic, and structural aspects of the dam. The engineering techniques employed give a reasonably accurate assessment of the conditions of the dam. It should be realized that certain engineering aspects cannot be fully analyzed during a Phase I inspection. Assessment and remedial measures in the report include the requirements of additional indepth study when necessary.

Phase I reports include project information of the dam appurtenances, all existing engineering data, operational procedures, hydraulic/hydrologic data of the watershed, dam stability, visual inspection report and an assessment including required remedial measures.

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of the Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (flood discharges that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the design flood should not be interpreted as necessarily posing a highly inadequate condition. The design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition, and the downstream damage potential.

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

CONTENTS

NAME OF DAM: THELMA PITTS DAM

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam: Thelma Pitts Dam
State: Commonwealth of Virginia
County: Caroline
USGS 7.5 Minute Quadrangles: Sparta, Virginia and Penola, Virginia
Stream: Unnamed Tributary to the Maracossic Creek
Date of Inspection: 12 January 1981

BRIEF ASSESSMENT OF DAM

Thelma Pitts Dam is an earthfill embankment approximately 18.6 feet high[1] and 250 feet long. The principal spillway is a concrete drop inlet riser located near the left abutment[2]. An emergency spillway is located on each abutment. The dam, located about 0.9 miles west of Sparta, Virginia, is used for recreation. The dam is owned by Thelma Pitts, Sparta, Virginia 22552. Thelma Pitts Dam is a "small" size - "significant" hazard structure as defined by the Recommended Guidelines for Safety Inspection of Dams. The dam and appurtenant structures were in good overall condition at the time of inspection. Maintenance of the dam is considered to be inadequate. A stability check of the dam is not required.

Using the Corps of Engineers' screening criteria for initial review of spillway adequacy, the 100-year flood was selected as the spillway design flood (SDF). The spillway is capable of passing up to 45 percent of the SDF or 8 percent of the Probable Maximum Flood (PMF) without overtopping the non-overflow section of the dam. The spillway is adjudged as inadequate but not seriously inadequate.

The areas of seepage near the center of the dam and on the left abutment should be examined at regular intervals and after periods of heavy rain for turbidity and/or increase in flow which may indicate the potential for piping of embankment material.

[1]Measured from the streambed at the downstream toe to the embankment crest.
[2]Facing downstream.

Regular inspections should be made of the dam and appurtenant structures. A thorough check list should be compiled for use by the owner's representative as a guide for the inspections. Maintenance items should be completed annually.

A formal warning system and emergency action plan should be developed and implemented as soon as possible.

The following repair items should be accomplished as part of the general maintenance of the dam:

1) Remove all trees and brush growing on the embankment by cutting them off at ground level. Trees with a trunk diameter of greater than 3 inches should also have their root systems removed and the resultant holes backfilled, compacted, regraded and seeded. If turbidity and/or increased flows are noted, a qualified geotechnical engineering firm should be retained to perform a stability check of the dam.

2) Place riprap on the upstream face to minimize erosion due to wave action.

3) Backfill, compact and seed the erosion ditch at the junction of the left abutment and the downstream embankment, and the erosion ditch on the left abutment in the spillway discharge channel.

4) Remove logs lodged in the principal spillway and install a trash rack on the principal spillway.

5) Backfill, compact, and riprap the eroded areas beneath and beside the apron at the principal spillway outlet.

6) Line the stilling basin with riprap to prevent erosion and scouring of the pool.

7) Remove the sections of concrete pipe partially obstructing the outlet of the stilling basin.

8) Install a staff gage to monitor reservoir levels above normal pool.

NAME OF DAM: THELMA PITTS DAM

MICHAEL BAKER, JR., INC.

Michael Baker, III, P.E.
Chairman of the Board and
Chief Executive Officer

COMMONWEALTH OF VIRGINIA
MICHAEL
BAKER III
NO. 3176
CERTIFIED PROFESSIONAL ENGINEER

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Chief, Engineering

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Douglas L. Haller
Colonel, Corps of Engineers
District Engineer

Date: APR 21 1981

NAME OF DAM: THELMA PITTS DAM

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OVERALL VIEW OF DAM

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
NAME OF DAM: THELMA PITTS DAM ID# VA 03343

SECTION 1 PROJECT INFORMATION

1.1 General

1.1.1 Authority: Public Law 92-367, 8 August 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a national program of safety inspections of dams throughout the United States. The Norfolk District has been assigned the responsibility of supervising the inspection of dams in the Commonwealth of Virginia.

1.1.2 Purpose of Inspection: The purpose is to conduct a Phase I inspection according to the Recommended Guidelines for Safety Inspection of Dams (Reference 12, Appendix IV). The main responsibility is to expeditiously identify those dams which may be a potential hazard to human life or property.

1.2 Description of Project

1.2.1 Description of Dam and Appurtenances: Thelma Pitts Dam is an earthfill embankment approximately 18.6 feet high[1] and 250 feet long. The crest of the dam is about 12 feet wide and the minimum elevation of the crest is 1002.6 feet Temporary Bench Mark (T.B.M.)[2]. The slope of the upstream embankment is approximately 2.1H:1V (Horizontal to Vertical) and the slope of the downstream embankment varies between 1.9H:1V to 2.3H:1V. There is no information available on any possible zoning of the embankment. No evidence of an internal drainage system or slope protection for the dam was found.

[1]Measured from the streambed at the downstream toe to the embankment crest.
[2]All elevations are referenced to a Temporary Bench Mark located on top of the concrete intake riser. The assumed elevation is 1000.0 feet.

The principal spillway is a square concrete riser with an internal opening of four feet by four feet. It is located near the left abutment approximately 20 feet from the embankment crest. The riser has a crest elevation of 1000.0 feet T.B.M. Three of the four sides are 10 inch concrete walls. The upstream side of the riser contains 2 inch by 8 inch boards acting as stop logs. These stop logs make up the top 4 feet of the intake riser and can be removed to lower the reservoir level 4 feet. Water passing into the intake riser is transmitted through the dam by a 30 inch diameter concrete pipe that extends 63 feet to the toe of the dam. The pipe discharges onto a 6 foot long concrete apron before dropping into a stilling pool at the toe of the dam.

There is an emergency spillway located on each abutment. The emergency spillway located on the left abutment is a trapezoidal shaped, partially vegetated channel. It has a bottom width of about 36 feet and a top width of 57 feet. The spillway has a crest elevation of 1001.4 feet. There is an eleven foot wide bituminous access road partially lining this emergency spillway. The spillway discharge channel follows the bituminous road for about 30 feet past the embankment; it then turns right and follows a poorly defined channel through a wooded area and discharges into the downstream end of the stilling pool.

The emergency spillway on the right abutment has a crest elevation of 1001.6 feet T.B.M. This grass- and tree-lined trapezoidal channel is poorly defined. It has a bottom width of about 10 feet and gently rising side slopes with a top width of about 40 feet. Immediately downstream from the spillway is a small berm running perpendicular to the embankment to prevent discharge from flowing toward the toe of the dam.

The reservoir has a 1.37 square mile drainage area to the west of the dam. A second dam is located about 2900 feet upstream from the Thelma Pitts Dam and about 800 feet from the

back water of the Thelma Pitts Dam. The watershed consists primarily of woodland with only 10 percent of the drainage area being open and unforested land. Present development is limited to a few houses and churches in the upper reaches of the watershed.

1.2.2 Location: Thelma Pitts Dam is located in Caroline County, Virginia on an unnamed tributary of the Maracossic Creek, approximately 0.9 miles west of Sparta, Virginia. A Location Plan is included with this report in Appendix I.

1.2.3 Size Classification: The height of the dam is 18.6 feet; the reservoir storage capacity at the crest of the dam (elevation 1002.6 feet T.B.M.) is 78 acre-feet. Therefore, the dam is in the "small" size category as defined by the Recommended Guidelines for Safety Inspections of Dams.

1.2.4 Hazard Classification: Virginia Route 654 crosses the downstream channel over a four foot diameter concrete pipe approximately 200 feet downstream from the embankment. The apparently unmanned Sparta Volunteer Fire Company house is located within the flood plain approximately 300 yards downstream. A four foot diameter concrete pipe carries the flow from the downstream channel beneath the access road to the volunteer fire house. Loss of human life in the event of a dam failure is not considered highly probable. However, economic losses due to damage to Virginia Route 654, the access road to the fire house, and the fire house are likely in the event of dam failure. Thelma Pitts Dam is therefore considered to be in the "significant" hazard category as defined by the Recommended Guidelines for Safety Inspections of Dams. The hazard classification used to categorize dams is a function of location only and is not related to stability or probability of failure.

1.2.5 Ownership: The dam and reservoir are owned by Thelma Pitts, Sparta, Virginia 22552.

1.2.6 Purpose of Dam: The reservoir is used for recreational purposes.

1.2.7 Design and Construction History: According to the owner, a dam was first built on this site in 1950. This first dam failed due to the burrowing of small animals and was rebuilt in 1960. No other information on the design or construction history was available for use in this report.

1.2.8 Normal Operating Procedures: The reservoir level is maintained automatically by the crest of the principal spillway (elevation 1000.0 feet T.B.M.). No formal operating procedures are followed for this structure.

1.3 Pertinent Data

1.3.1 Drainage Area: The total drainage area tributary to Thelma Pitts Dam is 1.37 square miles. However, a second dam located approximately 2900 feet upstream from the Thelma Pitts Dam controls 1.14 square miles of the drainage area tributary to Thelma Pitts Dam.

1.3.2 Discharge at Dam Site: The maximum discharge from the reservoir is unknown.

Pool level at minimum top of dam:

Principal Spillway	86 c.f.s.
Right Emergency Spillway	40 c.f.s.
Left Emergency Spillway	125 c.f.s.

1.3.3 Dam and Reservoir Data: Pertinent data on the dam and reservoir are provided in the following table:

NAME OF DAM: THELMA PITTS DAM

TABLE 1.1 DAM AND RESERVOIR DATA

Item	Elevation (feet T.B.M.)	Reservoir Capacity Area (acres)	Reservoir Capacity Acre-feet	Reservoir Capacity Watershed (inches)	Length (feet)
Top of dam	1002.6	15.9	78	1.1	2900
Emergency spillway Rt.	1001.6	13.9	63	0.9	2660
Emergency spillway Lt.	1001.4	13.1	60	0.8	2610
Principal spillway crest	1000.0	11.2	43	0.6	2280
Streambed at toe	984.0	-	-	-	-

NAME OF DAM: THELMA PITTS DAM

SECTION 2 - ENGINEERING DATA

2.1 Design: Design plans, specifications, and boring logs were not available for use in preparing this report. No stability analyses or hydrologic and hydraulic data were available for review.

2.2 Construction: Construction records, as-built plans, and inspection logs were not available for review.

2.3 Evaluation: No design or construction records were available for use in assessing the condition of the dam. All evaluations and assessments in this report were based upon field observations, conversations with the owner, and office analyses.

SECTION 3 - VISUAL INSPECTION

3.1 Findings

3.1.1 General: The field inspection was conducted on 12 January 1981. At the time of the inspection, the pool elevation was at 999.7 feet T.B.M., the tailwater elevation was 984.3 T.B.M., and the weather was clear with a temperature of 12 degrees Fahrenheit. The ground surface on the embankment and the abutments was generally frozen. The dam and appurtenant structures were found to be in fair overall condition at the time of inspection. Deficiencies found during the inspection will require remedial treatment. The following are brief summaries of these deficiencies. A Field Sketch of conditions found during the inspection is presented as Plate 1 in Appendix I. The complete visual inspection check list is provided in Appendix III. No record was found of any previous inspections.

3.1.2 Dam: The embankment was found to be in generally fair condition with no surface cracks or slides observed. The upstream embankment is well vegetated with grass and some small brush near the water surface. There was erosion due to wave action on the upstream embankment. The downstream embankment is heavily vegetated with numerous trees. Erosion was observed at the junction of the left abutment and the downstream embankment. There was also an erosion channel about 40 feet downstream from the embankment on the left abutment, due to runoff from Virginia Route 721 and the access road.

Some areas of slight seepage were detected beyond the toe near the center of the dam and a small seep was detected on the left downstream abutment. No evidence of an internal drainage system was found during the inspection.

3.1.3 Appurtenant Structures: The principal spillway (as described in Section 1.2.1) was found to be in fair condition. No signs of cracking or spalling of the concrete were observed on the inlet structure. However, there is no

trash rack on the inlet and several logs were lodged within the inlet structure. The outlet area was in fair condition. The 6 foot long concrete apron contained several small cracks. The area around the outlet and the banks of the stilling pool were eroded. Sections of a 30-inch diameter concrete conduit were located in the outlet channel about 140 feet downstream from the outlet. These pipes lie in a haphazard manner and partially obstruct the stilling pool where it discharges into the downstream channel. Bulging was observed in places on the downstream slope of the embankment. This bulging is probably the result of either trees growing on the dam or downhill creep.

The approach area to the emergency spillway on the left abutment is broad and unobstructed. The spillway is fairly well vegetated and is partially lined with a bituminous access road. No significant erosion or sloughing has occurred upstream from the crest. The discharge channel is not well defined downstream of the crest. A small gully has formed in the discharge channel due to runoff from Virginia Route 721 and the access road.

The approach area to the secondary emergency spillway on the right abutment is broad and contains many trees and bushes. The channel is not well defined. No signs of erosion or sloughing were observed. A small earth berm diverts flow from the spillway away from the toe of the dam. The downstream channel is wooded with many six to ten inch diameter trees.

3.1.4 Reservoir Area: The area surrounding the reservoir is moderately sloping. The slopes are wooded and in good condition with no evidence of erosion. Soundings taken at the time of inspection show the water to be 11.5 feet at a distance of 30 feet from shore near the center of the embankment.

3.1.5 Downstream Channel: The downstream channel area is overgrown with brush and trees. The stream passes under Virginia Route 654

through a 4 foot diameter concrete pipe about 200 feet downstream from the embankment. The stream also passes through another 4 foot diameter concrete pipe about 1000 feet downstream at the access road to the Sparta Volunteer Fire Company. The channel has a slope of about 1 percent and enters the Maracossic Creek about 1100 feet downstream.

3.1.6 Instrumentation: There was no instrumentation present at the dam.

3.2 Evaluation: In general, the dam and appurtenant structures were in good condition. The downstream embankment should be cleared of all trees and brush by cutting them off at ground level. Trees with a trunk diameter of greater than three inches should also have their root systems removed. The resultant holes should then be backfilled, compacted, regraded, and seeded. Riprap should be placed on the upstream face to minimize wave erosion. The erosion gullies on the left abutment should also be backfilled, compacted, and seeded. The logs lodged inside the principal spillway intake riser should be removed and a trash rack installed to prevent debris from clogging the principal spillway. The areas of erosion beneath and around the sides of the spillway outlet apron should be backfilled, compacted, and riprapped to prevent erosion of the toe of the dam. The discharge basin should be lined with riprap to prevent erosion and scouring of the pool. The sections of concrete pipe partially obstructing the stilling basin outlet should be removed.

The seep areas near the center of the dam and on the left abutment should be examined at regular intervals and after periods of heavy rain for turbidity and/or increase in flow, which may indicate the potential for piping of embankment material. If turbidity and/or increased flows are noted, a qualified geotechnical firm should be retained to perform a stability check of the dam.

A staff gage should be installed to monitor reservoir levels above normal pool.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 Procedures: Operation of the dam is an automatic function controlled by the principal spillway and the two emergency spillways. Water entering the reservoir flows into the principal spillway at elevation 1000.0 feet T.B.M. When inflow is sufficient to cause the reservoir level to rise above elevation 1001.4 feet T.B.M., discharge takes place through the emergency spillway on the left abutment. When the reservoir level rises above elevation 1001.6 feet T.B.M., water discharges through the emergency spillway on the right abutment.

4.2 Maintenance of Dam: Maintenance of the dam is the responsibility of the owner. An inspection or maintenance schedule has not been instituted.

4.3 Maintenance of Operating Facilities: The only operating facilities at the dam are the stop logs in the riser of the principal spillway. These logs can be used to control the reservoir level and dewater the reservoir 4 feet. The maintenance of this facility is the responsibility of the owner. A formal inspection and maintenance schedule has not been instituted.

4.4 Warning System: At the time of inspection, there was no warning system or emergency action plan in operation.

4.5 Evaluation: Maintenance of the dam in the past has been inadequate. Regular inspections of the dam and appurtenant structures should be made and documented. A thorough check list should be compiled for use by the owner's representative as a guide for the inspections. Maintenance items should be corrected annually. A warning system and emergency action plan should be developed and implemented as soon as possible.

SECTION 5 - HYDRAULIC/HYDROLOGIC DATA

5.1 Design: No design data were available for use in preparing this report.

5.2 Hydrologic Information: No rainfall, stream gage or reservoir stage records are maintained for this dam.

5.3 Flood Experience: No records were available.

5.4 Flood Potential: The Probable Maximum Flood (PMF), 1/2 Probable Maximum Flood (1/2 PMF), and 100-year flood were developed and routed through the reservoir by use of the HEC-1 DB computer program (Reference 9, Appendix IV) and appropriate unit hydrograph, precipitation and storage-outflow data. Clark's T_C and R coefficients for the local drainage areas were estimated from basin characteristics. The rainfall applied to the unit hydrograph was taken from publications by the U.S. Weather Bureau and the National Oceanic and Atmospheric Administration (References 16 and 17, Appendix IV). Rainfall losses for the PMF and 1/2 PMF were estimated at an initial loss of 1.0 inches and a constant loss rate of 0.05 inches per hour thereafter. Rainfall losses for the 100-year flood were estimated at an initial loss of 1.5 inches and a constant loss rate of 0.15 inches per hour thereafter.

5.5 Reservoir Regulation: Pertinent dam and reservoir data are provided in Table 1.1, Paragraph 1.3.3.

Regulation of flow from the reservoir is primarily automatic. Normal flows are maintained by the crest of the principal spillway at elevation 1000.0 feet T.B.M. Some manual regulation of flow is possible by the removal of the wooden stop logs from the upstream side of the concrete crest riser. By removing these stop logs, the spillway crest can be lowered to elevation 996.0 feet T.B.M. Water may also discharge through the emergency spillway on the left abutment when the reservoir rises above an elevation of 1001.4 feet T.B.M. In addition, there is an emergency spillway on the right abutment with a crest elevation of 1001.6 feet T.B.M.

Outlet discharge capacity was computed by hand. Reservoir area was estimated from the Sparta, Virginia and Penola, Virginia, 7.5 minute USGS quadrangles, and storage capacity curves above normal pools were computed

by the HEC-1 DB program. All flood routings were begun with the reservoir at normal pool. Flow through the spillways was included in the routings.

5.6 Overtopping Potential: The probable rise of the reservoir and other pertinent information on reservoir performance are shown in the following table:

TABLE 5.1 RESERVOIR PERFORMANCE

Item	Normal[1]	Hydrographs 100-Year	1/2 PMF	PMF[2]
Peak flow, c.f.s.				
Inflow	1	1272	3742	7573
Outflow	1	1248	3715	7541
Peak elev., ft. T.B.M.	1000.0	1003.9	1005.1	1006.5
Non-overflow section[3] (elev. 1002.6 ft. T.B.M.)				
Depth of flow, ft.	-	1.3	2.5	3.9
Average velocity, f.p.s.	-	5.3	7.3	9.2
Total duration of overtopping, hrs.	-	4.4	12.3	21.1
Tailwater elev., ft. T.B.M.	984.3	-	-	-

[1]Conditions at time of inspection.
[2]The PMF is an estimate of flood discharges that may be expected from the most severe combination of critical meterologic and hydrologic conditions that are reasonably possible in a region.
[3]Velocity estimates were based on critical depth at control section.

5.7 Reservoir Emptying Potential: The reservoir can be drawn down 4 feet by removal of the wooden stop logs from the upstream side of the intake riser. Neglecting inflow, the reservoir can be drawn down 4 feet from normal pool in approximately 30 hours. This is equivalent to an approximate drawdown rate of about 3.2 feet per day, based on the hydraulic height measured from normal pool divided by the time to lower the reservoir 4 feet.

5.8 Evaluation: Thelma Pitts Dam is a "small" size - "significant" hazard dam requiring evaluation for a spillway design flood (SDF) in the range between the

100-year flood and the 1/2 PMF. Due to the risk involved, the 100-year flood was selected as the SDF. The 100-year flood was routed through the reservoir and found to overtop the dam by a maximum depth of 1.3 feet with an average critical velocity of 5.3 feet per second (f.p.s.). Total duration of dam overtopping would be 4.4 hours. The spillways are capable of passing up to 8 percent of the PMF or 45 percent of the SDF without overtopping the dam.

Conclusions pertain to present day conditions and the effect of future development on the hydrology has not been considered.

SECTION 6 - DAM STABILITY

6.1 Foundation and Abutments: No information is available on foundation conditions other than observations made at the time of the inspection. The dam is located in the Atlantic Coastal Plain geologic region, and the predominant deposit in the area of the dam is Tertiary-age Calvert formation consisting of interbedded sand and clay. The Geologic Map of Virginia also shows Quaternary-age upland gravel and sand existing at the surface in the area. An eroded soil exposure adjacent to the outlet conduit discharge in the left downstream abutment contained reddish-brown clayey sand with thin lenses of light gray clayey silt. A slight amount of clear seepage was observed from the abutment at that point. Small seeps and wet areas were also observed below the toe of the downstream embankment. Small amounts of iron precipitate were present in some of these wet areas. However, the seepage did not appear turbid at the time of inspection, and no evidence of piping of foundation or abutment material was observed at any of these locations. Based on the visual inspection, it is believed that the dam has no internal drainage system. No information was available concerning the keying of the embankment into the foundation.

6.2 Embankment

6.2.1 Materials: No information is available on the nature of the embankment materials other than observations made at the time of inspection. Embankment material at the surface of the downstream face was observed to consist of reddish-brown clayey silt with fine sand. The plasticity of this soil was judged to be low.

6.2.2 Stability: Design plans or the results of a previous stability analysis were not available for use in this investigation. The embankment is assumed to be a homogeneous type consisting of fine-grained silty soils of low plasticity (classified as ML according to the USCS system). The dam is 18.6 feet high with a crest width of 12 feet. The downstream embankment was observed to have a 1.9H:1V slope at Station 0+96 where the outlet conduit passes through the dam, and a 2.3H:1V slope

at Station 2+00 near the center of the embankment. The upstream embankment slopes at 2.1H:1V at Station 2+00. In the event of an emergency, the reservoir can be drawn down a total of four feet below the top of the concrete drop inlet by removing the wooden stop logs from the upstream side of the inlet. According to calculations made as part of this investigation, the dam is subject to rapid drawdown (3.2 feet per day), even though the total drawdown is limited to four feet. This rate is greater than the critical rate for earth dams of 0.5 feet per day.

According to guidelines outlined in Design of Small Dams by the U.S. Department of Interior, Bureau of Reclamation, the upstream slope of a small homogeneous dam constructed of ML soils, with a stable foundation, should be 3.5H:1V if subject to rapid drawdown. The recommended downstream slope is 2.5H:1V. A crest width of 13.7 feet is recommended, considering the height of the dam. Based on these guidelines, both the upstream and downstream slopes and the crest width are inadequate.

Signs of instability such as tension cracks, misalignment of the crest, or unusual movement at the downstream toe were not observed. However, slight bulging of the downstream slope of the dam was observed in several places, particularly on the left half of the embankment. This bulging may be the result of the many trees taking root in the embankment, or the result of slow downhill creep of the embankment soil, or both. Erosion of the embankment was very slight except for the area of the downstream embankment and abutment adjacent to the outlet discharge. The erosion had cut slightly into the toe of the slope on each side of the outlet conduit. A shallow erosion gully was also observed at the junction of the downstream face and the left abutment. No seepage was observed on the face of the embankment, but the downstream slope was covered with brush and trees up to one foot in diameter.

NAME OF DAM: THELMA PITTS DAM

6.2.3 Seismic Stability: The dam is located in Seismic Zone 1, which presents no hazard from earthquakes according to the Recommended Guidelines for Safety Inspection of Dams by the Department of the Army, Office of the Chief of Engineers. This determination is contingent on the requirements that static stability conditions are satisfactory and conventional safety margins exist.

6.3 Evaluation: The results of a previous stability analysis were not available for review. Both the upstream and downstream slopes are steeper than recommended in the Bureau of Reclamation guidelines. The crest width is less than the recommended width of 13.7 feet. However, other than the slight bulging of the downstream face which is not considered to be serious at this time, no major signs of instability were observed during the inspection. A stability check is not considered to be necessary.

As discussed in Section 5 of this report, the dam would be overtopped by the design flood. The SDF would overtop the dam by a maximum depth of 1.3 feet with an average critical velocity of 5.3 feet per second (f.p.s.). The total duration of overtopping would be about 4.4 hours. Since the critical velocity is less than the effective eroding velocity for a vegetated earth embankment, and the depth and duration of overtopping are small, the overtopping is not considered detrimental to the embankment.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment: There were no engineering data available for use in preparing this report. Deficiencies discovered during the field inspection and office analyses require remedial treatment. The dam and appurtenant structures are generally in fair overall condition. Maintenance of the dam is considered inadequate. A stability check of the dam is not required.

Using the Corps of Engineers' screening criteria for initial review of spillway adequacy, the 100-year flood was selected as the SDF for the "small" size - "significant" hazard classification of Thelma Pitts Dam. The spillways are capable of passing up to 45 percent of the SDF or 8 percent of the PMF without overtopping the non-overflow section of the dam. The SDF was found to overtop the dam by a maximum depth of 1.3 feet with an average critical velocity of 5.3 feet per second (f.p.s.). A dam failure from overtopping would significantly increase the hazard to loss of life downstream from the dam over that which would exist just before overtopping failure. However, overtopping flows resulting from the SDF are not considered detrimental. Therefore, the spillway is adjudged as inadequate but not seriously inadequate.

There is no warning system or emergency action plan currently in operation.

7.2 Recommended Remedial Measures: Areas of seepage near the center of the dam and on the left abutment should be examined at regular intervals and after periods of heavy rain for turbidity and/or increase in flow which may indicate the potential for piping of embankment material. If turbidity and/or increased flows are noted, a qualified geotechnical firm should be retained to perform a stability check of the dam.

Regular inspections should be made of the dam and appurtenant structures. A thorough check list should be compiled for use by the owner's representative as a guide for the inspections. Maintenance items should be completed annually.

A formal warning system and emergency action plan should be developed and implemented as soon as possible.

The following repair items should be accomplished as part of the general maintenance of the dam:

1) Remove all trees and brush growing on the embankment by cutting them off at ground level. Trees with a trunk diameter of greater than 3 inches should also have their root systems removed and the resultant holes backfilled, compacted, regraded and seeded.

2) Place riprap on the upstream face to minimize erosion due to wave action.

3) Backfill, compact and seed the erosion ditch at the junction of the left abutment and the downstream embankment and the erosion ditch on the left abutment in the spillway discharge channel.

4) Remove logs lodged in the principal spillway and install a trash rack on the principal spillway.

5) Backfill, compact and riprap the eroded areas beneath and beside the apron at the principal spillway outlet.

6) Line the stilling basin with riprap to prevent erosion and scouring of the pool.

7) Remove the sections of concrete pipe partially obstructing the outlet of the stilling basin.

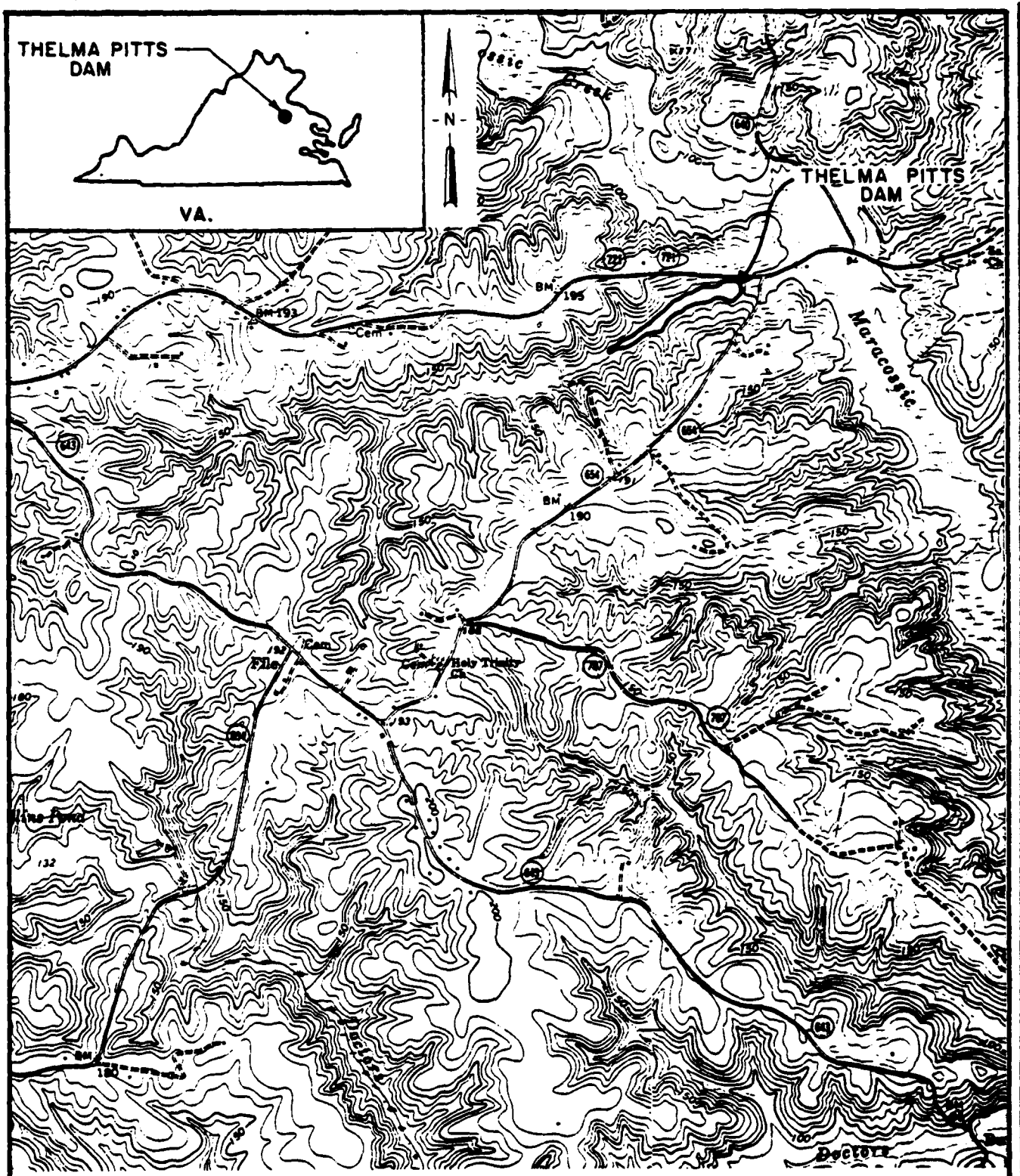
8) Install a staff gage to monitor reservoir levels above normal pool.

APPENDIX I

PLATES

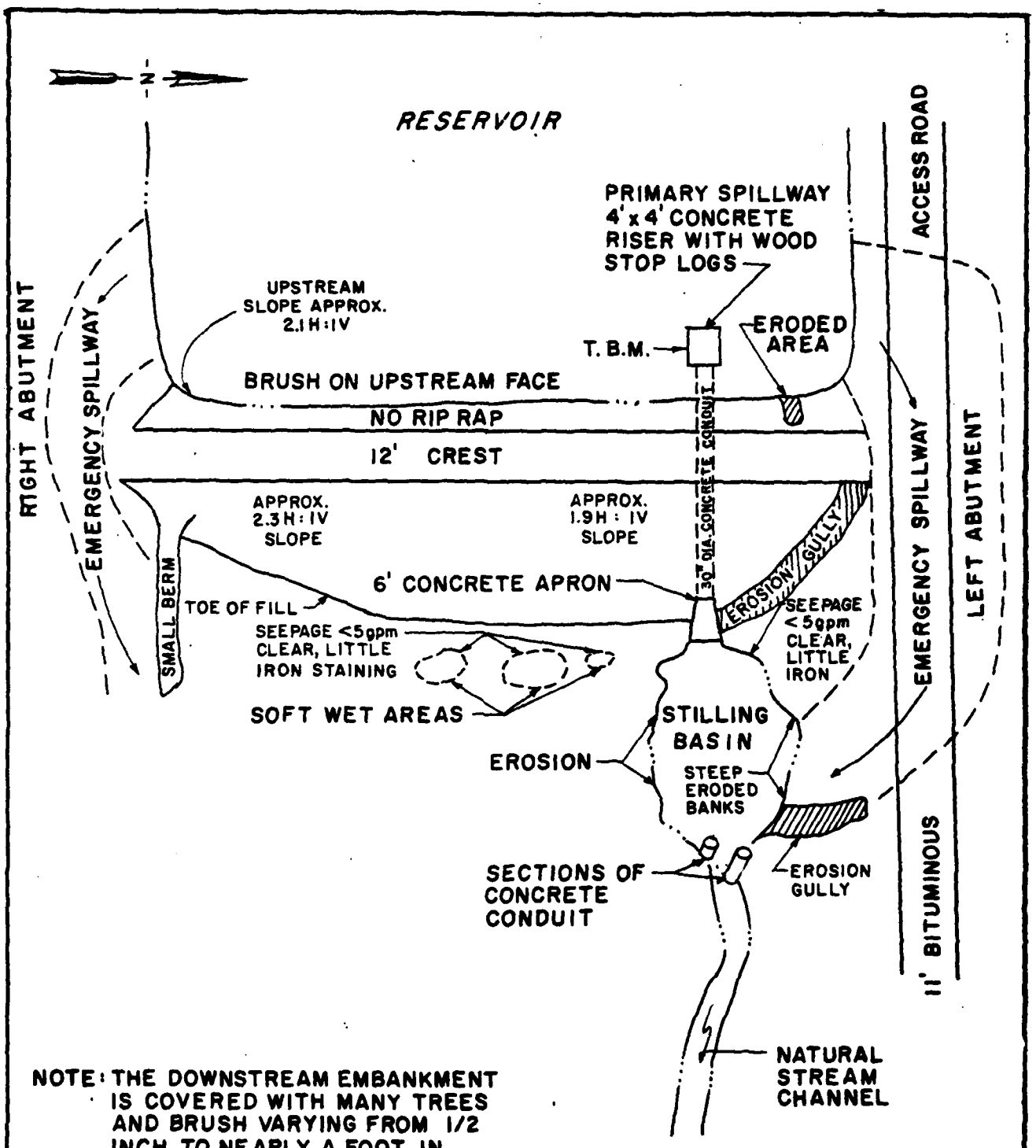
CONTENTS

NAME OF DAM: THELMA PITTS DAM



REFERENCES:
1. U.S.G.S. 7.5' SPARTA, VA QUADRANGLE. 1968
2. U.S.G.S. 7.5' PENOLA, VA. QUADRANGLE. 1969

LOCATION PLAN
THELMA PITTS DAM



NOTE: THE DOWNSTREAM EMBANKMENT IS COVERED WITH MANY TREES AND BRUSH VARYING FROM 1/2 INCH TO NEARLY A FOOT IN DIAMETER.

FIELD SKETCH

THELMA PITTS DAM

MICHAEL BAKER, JR., INC.

12 JANUARY 1981

NO SCALE

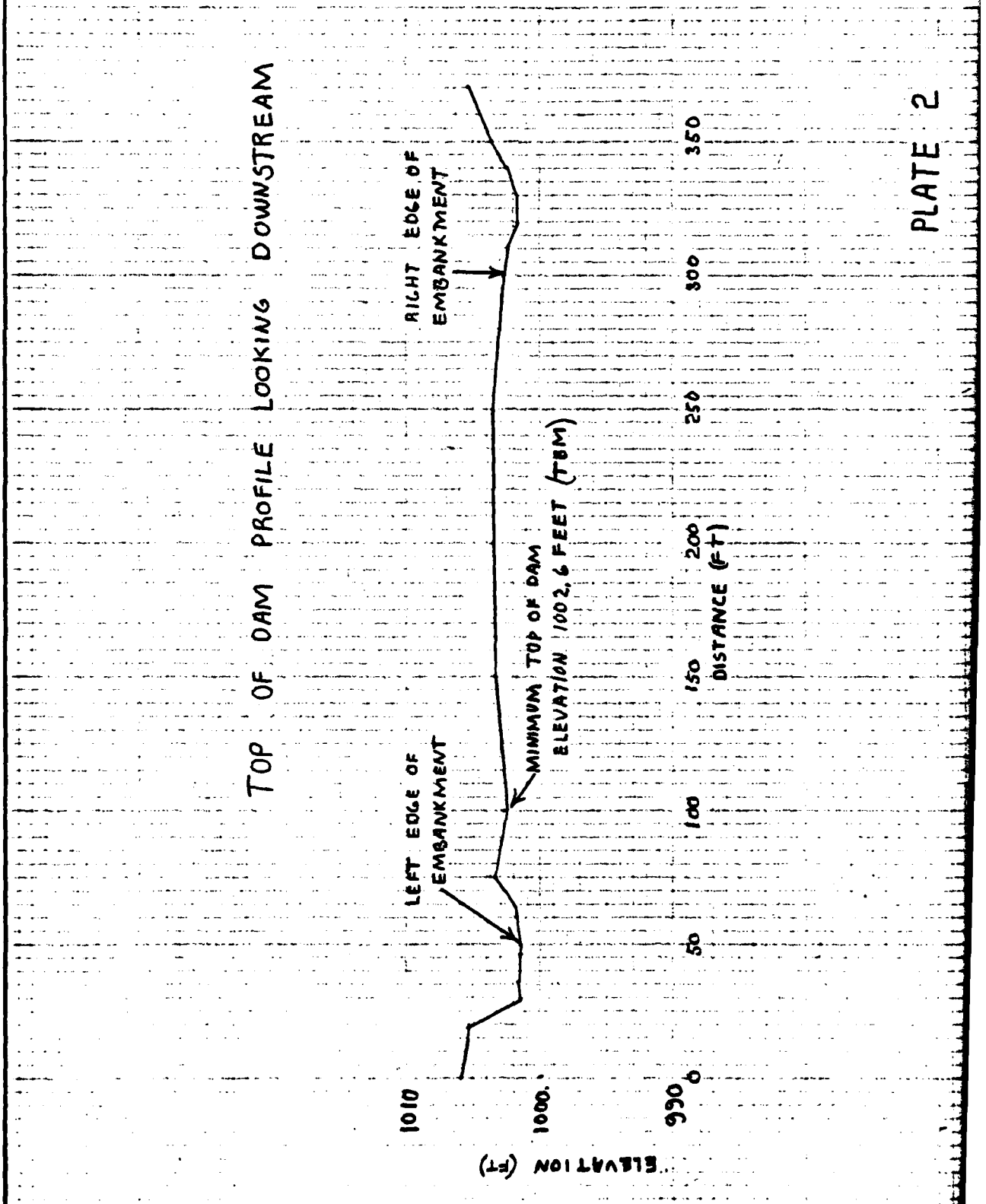
PLATE 1

MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject VIRGINIA DAMS S.O. No.
Thelma Pitts Dam Sheet No. of
Top-of-dam Profile Drawing No.
Computed by APK Checked by Date

PLATE 2

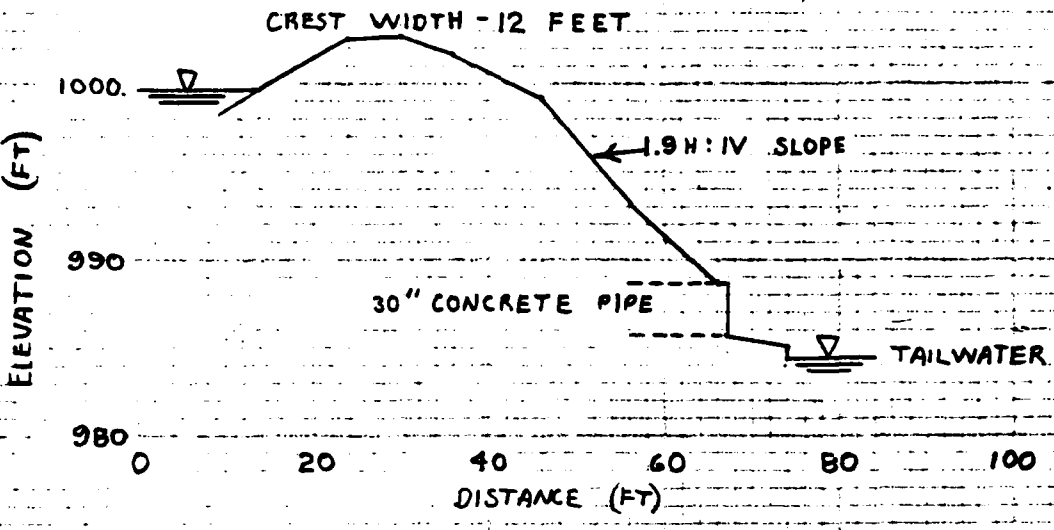


MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject VIRGINIA DAMS S.O. No.
Thelma Pitts Dam Sheet No. of
Cross Sections Drawing No.
Computed by APK Checked by Date

DAM CROSS-SECTION AT OUTLET WORKS
STA 0+96



DAM CROSS-SECTION STA 2+00

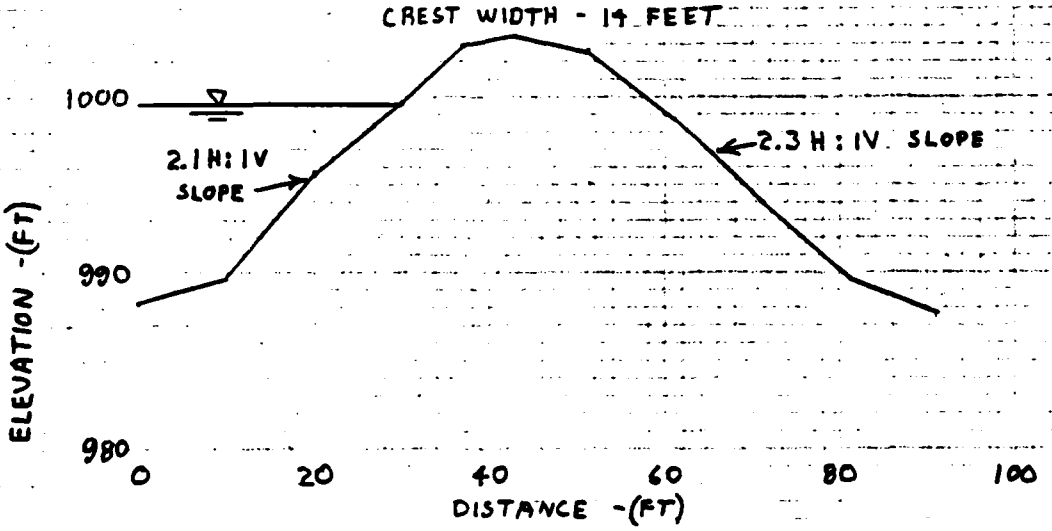


PLATE 3

APPENDIX II

PHOTOGRAPHS

CONTENTS

Note: Photographs were taken on 12 January 1981.

NAME OF DAM: THELMA PITTS DAM

THELMA PITTS DAM

PHOTO 1. Principal Spillway Inlet

PHOTO 2. Outlet of Principal Spillway and Stilling Basin

PHOTO 3. Erosion Gully at Junction of Left Abutment and Downstream Embankment

PHOTO 4. Erosion at Stilling Basin of Principal Spillway

PHOTO 5. View of Emergency Spillway on Left Abutment

PHOTO 6. View of Emergency Spillway Area on Right Abutment

APPENDIX III

VISUAL INSPECTION CHECK LIST

Check List
Visual Inspection
Phase 1

Name of Dam Thelma Pitts Dam County Caroline State Virginia Coordinates Lat. 3759.3
Long. 7714.7

Date of Inspection 12 January 1981 Weather Cold, sunny Temperature 12° F.

Pool Elevation at Time of Inspection 999.7 ft. T.B.M.* Tailwater at Time of Inspection 984.3 ft. T.B.M.*

*Elevations were referenced to a Temporary Bench Mark (T.B.M.) located at a point on top of the concrete intake riser. The assumed elevation was 1000.0 ft.

Inspection Personnel:

Michael Baker, Jr., Inc.:

Stephen Shoemaker
David Meredith
Anthony Klimek

Virginia State Water Control Board:

Edwin B. Constantine, III

Owner's Representatives:

Ms. Thelma Pitts

Stephen Shoemaker Recorder

EMBANKMENT

Name of Dam: THELMA PITTS DAM

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None observed	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None observed	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	A minor erosion berm exists on the upstream face of the dam just above the water level. This berm appears to have been created from wave action. An erosion channel was observed on the downstream side of the left abutment. This channel appears to be the result of storm water runoff from Virginia Route 721 and the private access road to the dam. There is an overly steep area where this erosion channel drops into the discharge channel of the principal spillway. Bulging was observed in places on the downstream slope of the embankment.	Riprap should be placed on the upstream face of the dam to minimize erosion due to wave action. The erosion channel should be backfilled, compacted, and seeded. The bulging is probably the result of either trees growing on the dam or downhill creep. The bulges should be regraded in conjunction with removal of the trees. The areas of bulging should be examined in future inspections.

EMBANKMENT

Name of Dam THELMA PITTS DAM

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Vertical and horizontal alignment of the crest both appear to be good. There is no evidence of settlement or sloughing at the crest of the dam, and the crest is clear of brush. A footpath runs along the crest of the dam.	
RIPRAP FAILURES	There is no riprap on the dam.	Riprap should be placed on the upstream embankment to minimize erosion due to wave action.
VEGETATION	The embankment is covered with brush and small trees. Most of the trees have a diameter of less than 1 ft.; however, there are several pines with a diameter greater than 1 ft. Cut trees along the embankment indicated the possible presence of beavers. The owner noted that a previous dam at this location had failed due to burrowing of small animals into the embankment of the dam.	Trees should be removed from the embankment by cutting them off at ground level. Trees with a trunk diameter greater than 3 in. should also have their root systems removed and the holes backfilled, compacted, and seeded.

EMBANKMENT

Name of Dam: THELMA PITTS DAM

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
EMBANKMENT MATERIALS	Embankment materials at the surface of the downstream face were observed to consist of reddish-brown clayey silt with fine sand. The plasticity of this soil was judged to be low. The ground surface on the embankment and abutments was generally frozen at the time of inspection.	
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	There is an erosion gully running from the emergency spillway down along the junction of the left abutment and downstream embankment to the toe of the dam. There is also an erosion gully about 40 ft. downstream from the embankment on the left abutment. This erosion is believed to be caused by stormwater runoff from Virginia Route 721. Erosion was also observed around the outlet of the principal spillway.	The erosion gullies should be backfilled, compacted, and seeded. The eroded area around the spillway outlet should be backfilled, compacted and riprap placed in the area to prevent further erosion of the toe.
ANY NOTICEABLE SEEPAGE	Ponded water and soft, spongy soil located at the toe of the dam indicate seepage from foundation soils. This seepage, estimated at a total of less than 5 g.p.m. at the time of inspection, collects and flows into the outlet discharge channel. Seepage was also observed within foundation material in the eroded bank at the left abutment near the outlet discharge.	None of these areas is considered to be serious. They should be visually examined in future inspections and their conditions recorded.

EMBANKMENT

Name of Dam: THELMA PITTS DAM

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
STAFF GAGE AND RECORDER	None observed	A staff gage should be installed to monitor reservoir levels above normal pool.
DRAINS	None observed	

OUTLET WORKS

Name of Dam: THELMA PITTS DAM

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	The 30 in. diameter concrete discharge conduit, which runs from the intake structure to the outlet channel, appears to be intact and in good condition.	
INTAKE STRUCTURE	The intake structure is a 4 ft. x 4 ft. drop inlet with 10 in. thick concrete walls. The upstream face of the drop inlet is open to a depth of 4 ft. where wooden stop logs (planks) lie across the opening. These wooden planks can be used to regulate the height of the reservoir. The concrete drop inlet appears to be in good condition with no observable cracks or spalling. Several large logs are lodged within the 12 ft. deep inlet structure.	The logs which are lodged within the drop inlet structure should be removed. A trash rack should be installed over the inlet to prevent debris from entering the inlet structure.
OUTLET STRUCTURE	The outlet structure is comprised of a 6 ft. long concrete discharge apron. Erosion has occurred underneath and along the sides of the discharge apron, and the apron is cracked in several places. This apron discharges in an uncontrolled manner into an eroded stilling pool.	The area beneath and along the sides of the apron should be backfilled and riprap placed around the apron to prevent erosion of the toe of the dam. The discharge pool should be lined with riprap to prevent scouring and erosion.

OUTLET WORKS

Name of Dam: THELMA PITTS DAM

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
OUTLET CHANNEL	Sections of 30 in. diameter concrete conduit were located in the outlet channel about 40 ft. downstream from the outlet. These pipes lie in a haphazard manner and partially block the stilling pool where it discharges into the downstream channel. This conduit at one time may have extended the discharge channel away from the outlet structure. This conduit may have washed away, thereby allowing the formation of the eroded basin adjacent to the outlet structure at the toe of the dam.	The sections of concrete conduit obstructing the channel should be removed.
EMERGENCY GATE	There are no emergency gates or other facilities for draining the reservoir.	The reservoir level can be drawn down approximately 4 ft. by removing the wooden stop logs within the drop inlet structure.

EMERGENCY SPILLWAY

Name of Dam: THELMA PITTS DAM

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	None	
APPROACH CHANNEL	None	
DISCHARGE CHANNEL	The primary emergency spillway is located along the left abutment of the dam. A bituminous access road partially lines the primary emergency spillway and discharge channel. The downstream end of the discharge channel is poorly defined, contains many trees, and drops abruptly into the eroded stilling basin at the toe of the dam.	
BRIDGE AND PIERS	None	

EMERGENCY SPILLWAY

Name of Dam: THELMA PITTS DAM

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SECONDARY EMERGENCY SPILLWAY	A secondary emergency spillway is located on the right abutment of the dam. This spillway has a smaller cross sectional area and a crest elevation 0.2 ft. higher than the principal emergency spillway. A small earth berm diverts flow away from the toe of the dam. The channel contains many trees 6-10 in. in diameter and brush. No erosion of the channel or side slopes was observed. The secondary emergency spillway channel is not well defined.	

INSTRUMENTATION

Name of Dam: THELMA PITTS DAM

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None observed	
OBSERVATION WELLS	None observed	
WEIRS	None observed	
PIEZOMETERS	None observed	
OTHER		

RESERVOIR

Name of Dam: THELMA PITTS DAM

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	The land surrounding the reservoir is generally forested. The slopes are moderate, from 2 to 7%, and there is no evidence of any significant erosion problems.	
SEDIMENTATION	The extent of sedimentation in the reservoir could not be directly observed, however, sedimentation is not expected to be significant. The reservoir was determined to be 11.5 ft. deep at a distance of 30 ft. from the upstream face of the dam.	
OTHER	Another small earthfilled embankment was observed approximately 2900 ft. upstream of the Thelma Pitts Dam.	

DOWNSTREAM CHANNEL

Name of Dam: THELMA PITTS DAM

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	There is a heavy growth of brush and trees within the downstream channel. A road embankment, Virginia Route 654, crosses the downstream channel approximately 200 ft. downstream of the dam. A 4 ft. diameter concrete conduit carries the stream bank through the embankment. The paved surface of the road embankment is about 10 ft. higher than the streambed.	
SLOPES	The downstream channel has a gentle, gradual slope. The overbanks are covered with trees and dense brush.	
APPROXIMATE NO. OF HOMES AND POPULATION	An unmanned volunteer fire house is located within the flood plain approximately 300 yd. downstream of the dam. The access road to this fire house is carried over the downstream channel by a 4 ft. diameter concrete culvert.	Loss of human life in the event of a dam failure is not considered highly probable.

APPENDIX IV

GENERAL REFERENCES

GENERAL REFERENCES

1. Bureau of Reclamation, U.S. Department of the Interior, Design of Small Dams, A Water Resources Technical Publication, Revised Reprint, 1977.

2. Chow, Ven Te, Handbook of Applied Hydrology, McGraw - Hill Book Company, New York, 1964.

3. Chow, Ven Te, Open Channel Hydraulics, McGraw - Hill Book Company, New York, First Edition, 1959.

4. Commonwealth of Virginia, "Geologic Map of Virginia," Department of Conservation and Economic Development, and Division of Mineral Resources, 1963.

5. HR 33, "Seasonal Variations of Probable Maximum Precipitation, East of the 105th Meridian for Areas 10 to 1000 Square Miles and Durations of 6 to 48 Hours," (1956).

6. King, Horace Williams and Brater, Ernest F., Handbook of Hydraulics, Fifth Edition, McGraw - Hill Book Company, New York, 1963.

7. Soil Conservation Service, "National Engineering Handbook - Section 4, Hydrology," U.S. Department of Agriculture, 1964.

8. Soil Conservation Service, "National Engineering Handbook - Section 5, Hydraulics," U.S. Department of Agriculture.

9. U.S. Army, Hydrologic Engineering Center, "Flood Hydrograph Package (HEC-1), Dam Safety Investigations, Users Manual," Corps of Engineers, Davis, California, September 1978.

10. U.S. Army, Hydrologic Engineering Center, "HEC-2 Water Surface Profiles, Users Manual," Corps of Engineers, Davis, California, October 1973.

11. U.S. Army, "Inventory of United States Dams," Corps of Engineers, 9 September 1978.

12. U.S. Army, Office of the Chief of Engineers, "Appendix D, Recommended Guidelines for Safety Inspection of Dams," National Program of Inspection of Dams, Volume 1, Corps of Engineers, Washington, D.C., May 1975.

NAME OF DAM: THELMA PITTS DAM

13. U.S. Army, Office of the Chief of Engineers, Engineering Circular EC-1110-2-163 (Draft Engineering Manual), "Spillway and Freeboard Requirements for Dams, Appendix C, Hydrometeorological Criteria and Hyetograph Estimates," (August 1975).

14. U.S. Army, Office of the Chief of Engineers, Engineering Circular EC-1110-2-188, "Engineering and Design, National Program of Inspection of Non-Federal Dams," Corps of Engineers, Washington, D.C., 30 December 1977.

15. U.S. Army, Office of the Chief of Engineers, Engineer Technical Letter No. ETL 1110-2-234, "Engineering and Design, National Program of Inspection of Non-Federal Dams, Review of Spillway Adequacy," Corps of Engineers, Washington, D.C., 10 May 1978.

16. U.S. Department of Commerce, "Technical Paper No. 40, Rainfall Frequency Atlas of the United States for Durations from 30 Minutes to 24 Hours and Return Periods from 1 to 100 Years," Weather Bureau, Washington, D.C., May 1961.

17. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, "Hydrometeorological Report No. 51, Probable Maximum Precipitation Estimates, United States East of the 105th Meridian," Washington, D.C., June 1978.